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SHORT COMMUNICATION

EFFECT OF GRADED LEVELS OF *SACCHARUM OFFICINARUM* AS AN ADDITIVE TO *PANICUM MAXIMUM* (JACQ) SILAGE

Odedire JA^{1*} and TO Abegunde²



Odedire Adeolu

*Corresponding author: oadeolu@oauife.edu.ng

¹ Department of Animal Sciences, Obafemi Awolowo University, Ile – Ife, Nigeria

²Department of Agriculture, Animal Science and Production Unit, Joseph Ayo Babalola University, Ikeji-Arakeji, Nigeria

ABSTRACT

An experiment was conducted to evaluate the effect of graded levels of sugar cane (*Saccharum officinarum*) as an additive to Guinea grass (*Panicum maximum*) silage. A previously established guinea grass plot, totaling an area of 625m² was cut back and fertilized with urea at the rate of 200 kgN/ha. The pasture was then harvested at 6-weeks regrowth, chopped (5-10cm long), mixed with chopped sugar cane (1-3cm long) and ensiled in stack silos. Four treatments were formulated as follows: Treatment A = 10%w/w Sugar cane with *Panicum maximum*; Treatment B = 20%w/w sugar cane with *Panicum maximum*; Treatment C = 30%w/w sugar cane with *Panicum maximum*; Treatment D = *Panicum maximum* without additive; with the fresh *Panicum maximum* serving as Control. The yield values of 6,169 and 4,850 Kg DM/ha was observed for the fresh and ensiled *P. maximum*, respectively. The pH values of the ensiled forage were significantly ($P < 0.05$) highest in Treatment D (5.72) and least in Treatment C (4.20), while Treatments A and B were similar. Results showed significant ($P < 0.05$) reduction in the pH value of the ensiled grass as the content of sugar cane increased. Total cell wall (NDF) contents were similar and significantly reduced in ensiled guinea grass. Crude protein (CP) level was highest ($P < 0.05$) in 30% sugarcane additive silage (Treatment C) but similar in Treatments A, B, D and Control. The Crude fibre (CF) content was highest ($P < 0.05$) in the 10% sugarcane additive silage and lowest ($P < 0.05$) in the fresh un-ensiled guinea grass forage. Nitrogen Detergent Fibre (NDF) of the Control was higher ($P < 0.05$) than the ensiled grass across the treatments, while Acid Detergent Fibre (ADF) values of the ensiled grass increased significantly ($P < 0.05$) with increasing sugarcane inclusion with highest ($P < 0.05$) value recorded for the 30% sugarcane additive silage (Treatment C). It can, therefore, be concluded from this study that sugarcane can serve as an additive in ensiling guinea grass up to the rate of 30% w/w.

Key words: additive, ensiling, sugarcane, forage , Guinea

INTRODUCTION

Inadequate supply of quality forage on a year round basis and high cost of conventional feedstuffs are major problems to the productivity of ruminants in Nigeria [1]. Livestock farmers face their biggest challenge during the dry season when a 'staircase' growth pattern is observed in animals as a result of inadequate animal feeds [2]. Under traditional systems of management in Nigeria, ruminants feed on unimproved native pastures and crop residues. At the onset of dry season, grass becomes scarce as a result of rapid drying up and lignification, hence yield and quality of forage from perennial tropical grasses decline rapidly during the dry season, leading to shortage in supply of quality feed during this period.

Panicum maximum (Guinea grass) is one of the most common and wide spread grasses in the derived savannah region of Nigeria. Guinea grass is tolerant of shade and fire, but susceptible to water logging or severe drought. Under good conditions, its nutritional value is high, having up to 12.5 % crude protein, total digestible nutrients (TDN) of 10.2 % and calcium, phosphorus and magnesium [3, 4]. These grasses are abundant in the wet season but scarce in the dry season and where available, they are highly lignified. Preservation, therefore, remains the solution to their availability during the dry season.

In the tropical and sub tropical humid regions, high humidity in the atmosphere and more rains in the production period limit the time of making hay, and ensiling is considered to be the most promising preservation technique. Ensiling is a process which involves the conservation of green fodder crops, grasses and the storage over long period(s). The resultant product, silage, is the preserved green fodder in succulent form under air tight conditions. Good quality silage is yellowish green in colour with a pleasant vinegar smell. Over time, tropical grass biomass increases with maturity but decreases in nutritive value. To overcome this problem, these grasses are frequently ensiled at an early growing stage. However, young plants have a high moisture content, high buffering capacity and a low level of soluble carbohydrates. These factors have a negative influence on the fermentation process, preventing a rapid lowering of the pH and thus allowing unwanted secondary fermentation, consequently damaging the quality of the final product [5]. This constraint can be removed by the application of additives. The main objective of applying additives, such as glucose and urea, in ensiling is to reduce pH more rapidly so as to preserve carbohydrates and proteins and inhibit the growth of microorganisms that might deteriorate the quality of the silage [6, 7]. The cost and availability of commercial silage additives are often a limiting factor and agro – industrial waste /by – products, such as molasses then becomes handy as an alternative. Molasses is a by – product of sugar industry where the raw material is sugarcane (*Saccharum officinarum*).

Lactic acid concentrations of 37g/kg DM in elephant grass silage ensiled with 3% molasses was higher compared with 15g/kg DM concentration without molasses [8]. However, molasses is not easily available to smallholder dairy farmers due to its high price or due to remoteness of the farmers' farms from the sugar processing industries. Therefore, an alternative water soluble carbohydrate (WSC) source that is affordable by farmers is necessary for smallholder forage

preservation, hence the recourse to sugarcane. Previous work on sugarcane had reported a sharp decline in the cell wall content of ensiled *Panicum maximum* forage and a comparable crude protein content with the fresh unensiled grass [9] contrary to the observation of other researchers that reported significant decrease in crude protein content of ensiled grass using sugarcane and sugarcane bagasse as additives [10,11].

The objective of this study, therefore, was to investigate the optimum level of *Saccharum officinarum* as additive to *Panicum maximum* ensilage.

MATERIALS AND METHODS

The experiment was conducted at the sheep and goat unit of the Teaching and Research Farm, Obafemi Awolowo University, Ile-Ife, Nigeria situated in southwestern Nigeria at coordinates 7°28'N and 4°33'E at an altitude of 240 m above sea level. The average annual rainfall at the farm is about 1290 mm and the climate is sub-humid. The rainy (wet) season stretches from about April to October while the dry season is from November to March.

Pasture land preparation

A total land area of 625m² subdivided into sub plots of 5 X 5m² was used for *Panicum maximum* cultivation. Guinea grass was propagated vegetatively with each cutting measuring 12 – 15cm long with 3 tillers per stand. The planting distance was 0.5 X 1.0m. The established grass pasture was cut back and fertilized with urea at the rate of 200 kgN/ha for the purpose of this experiment. The grass was then harvested at 6-week regrowth, after the first cut back to determine the forage yield and subsequent analysis.

Yield determination and Laboratory analysis

Five plots were randomly selected and harvested with the aid of a hand sickle and biomass yields were recorded. The harvested forage was thoroughly mixed and subsamples taken for dry matter (DM) determination as described in the AOAC [12] and fibre analysis in accordance with the procedure of Van Soest [13]. The bulk of the remaining harvested forage was air wilted for 24 hours and chopped to 5- 10cm length to allow for easy compaction. Sugarcane was chopped to 1-3cm length.

Silage Production

Using a completely randomized design, four treatments were formulated in three replicates as follows:

Treatment A = 10% w/w sugarcane + *Panicum maximum*

Treatment B = 20% w/w sugarcane + *Panicum maximum*

Treatment C = 30% w/w sugarcane + *Panicum maximum*

Treatment D = *Panicum maximum* without any additive

Control = Fresh *Panicum maximum*

Ensiling was done in a stack silo, using plastic bags for 21 days. The pH values of the ensiled forages were obtained using a pH meter at the end of the 21st day, marking the termination of the silage process.

Statistical Analysis

Data obtained were subjected to a one way analysis of variance (ANOVA) according to the procedure of SAS [14] and the treatment means, where significant, were compared using Duncan's Multiple Range Test [15].

RESULTS

Table 1 shows the proximate composition of the freshly harvested guinea grass. Values observed for dry matter (DM), crude protein (CP), crude fibre (CF) were 29.81%, 10.76% and 28.96%, respectively.

The yield of *Panicum maximum* from cultivated plots and silage are as shown in Table 2. The values of 6,169 and 4,850 Kg DM/ha were obtained for the fresh and ensiled *P. maximum*, respectively. Physical characteristics of the silage produced include brownish green colour and a pleasant fruity aroma.

Table 3 shows the proximate composition and pH of the fresh and ensiled *Panicum maximum*. Crude protein (CP) level was highest ($P<0.05$) in 30% sugarcane additive silage (Treatment C). The CF level of Treatment A was significantly ($P<0.05$) higher than other treatments. Treatments B, C and D were similar and higher ($P<0.05$) than the control. The pH values reduced ($P<0.05$) with increasing levels of additive.

Table 4 shows the fibre analysis (Neutral Detergent Fibre and Acid Detergent Fibre) of fresh and ensiled *P. maximum*. Neutral Detergent Fibre content of the Control was higher ($P<0.05$) than the ensiled grass across the treatments. The NDF values, which is indicative of the total cell wall contents of the ensiled *P. maximum* were similar ($P>0.05$).

DISCUSSION

The CP value obtained in the current work was higher than values of 7.35%, 9.17% and 8.00% reported elsewhere [16, 17, 18, 19]. The high CP content of *Panicum maximum* reported in this study could have been as a result of the fertilizer application. It has been shown that fertilizer application, particularly urea, could improve the protein content of *Panicum maximum* to as high as 13 - 14% [20]. Crude protein values ranging from 10% to 17.81% from ages 2 – 6 weeks for improved *Panicum maximum* have been reported [21]. Crude protein values in the current study were, however, similar to those reported [21].

The CP values for Treatments A, B, D and Control were all similar. This result disagrees with the findings of Man and Wiktorsson [22] who reported a reduction in crude protein of silage made from cassava tops when molasses was used as an additive. Similar observation was also

reported [23] with Kudzu silage and [11] where it was observed that the CP content of Napier grass dropped below 4% when ensiled with sugarcane bagasse as an additive. The improvement in the CP content of the sugarcane additive treatments in the current experiment may be due to the fact that the dry matter of the herbage materials was sufficiently high to avoid seepage loss of silage protein since protein losses in the ensiling procedure have been reported to be dependent on the run off of the proteolytic end products with the effluent [22].

The Crude fibre (CF) was highest ($P < 0.05$) in the 10% sugarcane additive silage (Treatment A) and lowest in the Control. It was observed that ensiling with above 10% sugarcane did not affect the crude fibre content of the silage. The reasons for the high CF in the 10% sugarcane additive silage are unknown. There was a significant ($P < 0.05$) reduction in the pH value of the ensiled grass as the content of sugar cane increased. The ADF content of the silage increased with increasing sugarcane inclusion in the silage with highest ($P < 0.05$) value recorded for the 30% sugarcane additive silage (Treatment C). This may be as a result of the fact that sugarcane products are fibrous and not readily digestible by cellulolytic microorganisms. However, this result contradicts the report of Bautista-Trujillo *et al.* [24] who reported a reduction in the crude fibre and NDF contents of maize silage with molasses when compared with maize silage without additive or maize silage added with whey.

CONCLUSION

In regions where the cane molasses is relatively expensive or unavailable, inclusion of chopped sugarcane may be an alternative to the use of molasses as sugarcane inclusion up to the rate of 30% w/w appears a suitable alternative additive in the ensiling of *Panicum maximum* for ruminants feeding.

Table 1: Proximate composition (g/100gDM) of the fresh *Panicum maximum*

Dry matter	29.17
Crude protein	10.76
Crude fibre	28.96
Ether extracts	6.88
Ash	10.47
Nitrogen free extracts	33.7

Table 2: Yield of fresh and ensiled *Panicum maximum*

	Yield, Kg DM/ha
<i>Panicum maximum</i>	6,169
*Ensiled <i>Panicum maximum</i>	4,850

*Without additive

Table 3: Proximate composition and pH of the fresh and ensiled *P. maximum*

Treatment	% CP	% CF	% EE	% Ash	% NFE	pH
A	10.76 ^b	37.99 ^a	8.36 ^a	8.27 ^{cd}	18.50 ^a	4.84 ^b
B	11.23 ^b	31.78 ^b	7.36 ^{bc}	9.59 ^b	17.08 ^b	4.82 ^b
C	12.58 ^a	32.22 ^b	7.74 ^{ab}	8.01 ^d	13.89 ^c	4.20 ^c
D	11.53 ^{ab}	32.08 ^b	7.53 ^{bc}	8.59 ^c	11.73 ^d	5.72 ^a
Control	10.76 ^b	28.96 ^c	6.88 ^c	10.47 ^a	17.36 ^{ab}	ND
SEM	0.28	0.30	0.18	0.12	0.93	0.05

^{a,b,c,d} means within the column having different superscripts are significantly different (p<0.05)

A= 10% w/w Sugarcane with *P. maximum*, B= 20% w/w sugarcane with *P. maximum*, C= 30% w/w sugarcane with *P. maximum*, D = *P. maximum* without additive, ND= Not determined

Table 4: Neutral Detergent Fibre and Acid Detergent Fibre of fresh and ensiled *Panicum maximum*

Treatment	% NDF	% ADF
A	63.67 ^b	33.39 ^c
B	64.20 ^b	35.13 ^b
C	62.87 ^b	38.02 ^a
D	61.99 ^b	31.48 ^d
Control	70.04 ^a	30.58 ^d
SEM	0.57	0.38

^{a,b,c,d} means within the column having different superscripts are significantly different (p<0.05)

A= 10% w/w Sugarcane with *P. maximum*, B= 20% w/w sugarcane with *P. maximum*, C= 30% w/w sugarcane with *P. maximum*, D= 40% w/w sugarcane with *P. maximum*, Control = *P. maximum* without additive

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